NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

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No. 1
10/59

LAUNCHING VEHICLE

The launching vehicle used in this experiment is a conventional Juno II booster with one exception: a support cylinder has been added to the fourth stage to support the weight of the payload.

The rocket consists of a modified Army Jupiter IRBM with the three-stage cluster mounted in a spin tub assembly in the nose.

The Juno II stands 76-feet high and weighs about 60 tons including fuel. This will be its fifth firing:

1. December 6, 1958: Pioneer III space probe launched to an altitude of 63,000 miles.
2. March 3, 1959: Pioneer IV probe launched into orbit around the sun.
3. July 16, 1959: Vehicle was destroyed about five seconds after launch when it tilted sharply in an attempt to put a heavy composite radiation satellite into earth orbit.
4. August 14, 1959: A 12-foot inflatable sphere payload failed to achieve orbit due to premature fuel depletion in booster and malfunction in attitude control system for upper stages.

Main Stage

The ABMA-Jupiter IRBM is modified to increase fuel capacity by extending booster section and fuel tanks three feet. Fuel is high grade kerosene and the oxidizer is liquid oxygen.

The outer shell of the booster, made from rolled aluminum alloy sheets serves as the wall of the tanks. Bulkheads separate engine, fuel, and oxidizer tanks and the instrument compartment at the top of the stage.

The bell-shape thrust chamber is gimballed to use the exhaust jet to control the rocket's direction. Fuel cools the chamber walls before injection into the combustion area.

The turbine assembly which pumps fuel and liquid oxygen through the engine is driven by hot gases generated by combustion of the main propellants in a gas generator.

The Jupiter IRBM began flight tests in March 1957, 16 months after its development program began. It launched full-scale nose cones recovered from the Atlantic Ocean on May 18, 1958, and on July 17, 1958. Two monkeys were recovered after a 1500-mile Jupiter flight on May 28, 1959, in a NASA bio-medical experiment.

Upper Stages

NASA Jet Propulsion Laboratory developed the upper stage assembly of this launching vehicle originally for the Jupiter C vehicle used for reentry experiments. It was first adapted to the Jupiter booster for the Pioneer III launch on December 6, 1958.

The second stage is a hollow cylinder of 11 scaled-down solid fuel Sergeant rockets 42.5 inches long and 6 inches in diameter. A triangle of three similar rockets fitted inside the cylinder is the third stage. The third stage pulls out of its encasement when it ignites. The fourth stage, to which the payload is attached, is a single rocket fitted inside the third stage triangle.

During launch and first stage flight, the upper stage cluster is protected by an aerodynamic shroud which is released by explosive bolts and pushed aside by a lateral rocket prior to upper stage ignition.

Guidance

Guidance for the vehicle, the Delta Minimum Inertial Guidance Scheme, is the one used in the Jupiter IRBM and is located in the forward part of the booster.

After trajectory information is fed into the rocket's guidance computer (as late as 20 minutes prior to firing) the system thinks for itself. The only ground-to-booster control is the safety destruct system.

A platform stabilized by gyroscopes remains in stable position during booster flight after it is oriented on the pad toward the desired point of injection. Deviations of wind and velocity are measured by acceleration devices, fed into the guidance computer, and trajectory changes are automatically made by the steering system.

Steering is by the gimballed nozzle of the booster engine and variable thrust air nozzles.

Firing Procedure

The Juno II lifts off its pad vertically, tilting into trajectory during burning time of the first stage. After engine cut off, approximately three minutes after launch, explosive bolts separate the booster which is slowed and steered to one side by four small retro rockets to prevent interference with the upper stages.

The upper stages encased in the aerodynamic shroud coasts for some $7\frac{1}{2}$ minutes before the nose cone of the shroud is removed by explosive bolts and pushed aside by a lateral rocket.

The second stage ignites pulling the upper stage and payload assembly, spinning at 600 rpm, clear of the shroud. The second stage burns for six seconds, followed by a coasting period of two seconds. The third stage then ignites burning for an effective time of six seconds, followed by the fourth stage which also burns six seconds and injects the payload.

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PROJECT BACKGROUND AND EXPERIMENTS

BACKGROUND

The composite radiation satellite contains seven experiments designed to extend knowledge of outer space, particularly of radiation activity. The satellite weighs 91.5 pounds and emphasizes miniaturization of components.

The satellite was designed to gather scientific data as part of the United States contribution to the International Geophysical Year. It is the last firing of the IGY-planned series of space experiments.

The launching of the satellite is under direction of the National Aeronautics and Space Administration and is carried out by Army Ballistic Missile Agency.

Planning for the satellite began in March, 1958, when representatives of the experimenters met at Redstone Arsenal, Alabama. They were briefed by ABMA officials on the purpose of the experiment and determined which experiments could be carried in the satellite. Basis of final choice of experiments was complexity of equipment involved, how well they mated for telemetering requirements, and how much power was required.

The satellite was designed, fabricated, and tested by ABMA: Dr. Ernst Stuhlinger was test objectives director and Joseph Boehm, who designed the satellites in the original Explorer series, was satellite project engineer.

Following establishment of NASA, it assumed direction of the experiments with Herman E. LaGow appointed project engineer.

The orbiter is launched in a northeasterly direction and the extremities of its orbital paths will be 50 degrees latitude, North and South.

THE SATELLITE AND ITS EXPERIMENTS.

The 91.5 pound satellite is shaped like two truncated cones joined at the base.

There are two transmitters in the satellite: one operates on 20 megacycles and is powered by chemical batteries; the other operates on 108 megacycles and derives its power from solar energy. Measurements of six of the seven experiments will be transmitted by the solar-powered transmitter.

An automatic timing device will cut off the solar transmitter one year from the firing date, thus releasing the radio frequency for other purposes in accordance with international agreements.

1. Radiation Balance

The experiment is conducted by Dr. Verner E. Suomi of the University of Wisconsin.

The radiation balance of the Earth is nearly constant over the entire Earth for a period of several years. However, the Earth receives more energy from the sun near the Equator that it radiates into space. It radiates more energy into space from the poles than it receives from the sun. Thus energy must be transferred from the lower latitudes to the higher latitudes by means of ocean currents and the atmosphere. This transfer will be studied by measuring:

a. Direct radiation from the sun.

b. The fraction of this radiation diffusely reflected by the Earth, clouds and atmosphere.

c. The fraction of radiation which is converted into heat by the Earth and ultimately is re-radiated back into space in the far infra-red portion of the spectrum.

Six sensing elements are designed to measure the quantities: Two small hemispheres painted black to measure total energy at all wavelengths, two hemispheres painted white to measure radiation in the longer wavelengths while reflecting short wavelengths; two sensing elements which have a special coating making them absorption-sensitive to short wave radiation only. The latter, called Tabor sensors, are about one inch in diameter. The black and white sensors measure about one and one-quarter inch in diameter. The sensors are located at various points on the surface of the satellite.

2. Lyman-Alpha X-ray Experiment

This experiment is conducted by Dr. Herbert Friedman of the Naval Research Laboratory. It will measure ambient sun-produced Lyman-Alpha and soft X-rays. It is also expected to furnish significant data on increased activity due to solar flares on the sun's surface. Measurements are sought on solar ultra-violet emissions at the 1216 anstrom unit line.

The radiation intensity will be measured by means of a photo sensitive ion chamber cylindrical in shape, three-quarters of an inch in diameter and one and a quarter inches long. The chamber is fitted with a window made of lithium flouride. The chamber is sensitive to radiation between the 1040° Å and 1340° Å. The only radiation of noticeable intensity in this band is the Lyman-Alpha line of atomic hydrogen at 1216° Å which is to be measured.

The sensitivity of the ion chambers and their speed of response are adequate for monitoring the normal level of Lyman-Alpha radiation and the increase anticipated from solar flare activity.

The X-ray instrument is similar in size and shape to the Lyman-Alpha detector. It is filled with argon gas, has a beryllium window, and is sensitive to radiation wavelengths from 15 to 3 angstroms.

A photo cell is included to determine the aspect of the satellite with respect to the sun.

Outputs of the Lyman-Alpha ion chamber, the X-ray ion chamber and the photo cell are both fed into the 960 cps sub-carrier oscillator.

3. Heavy Primary Cosmic Ray

This experiment was designed by the late Dr. Gerhart Groetzinger of the Research Institute for Advanced Studies, (Martin Co.) Baltimore, Md. It employs an ion chamber to count cosmic rays in three classes. The three ranges have limits determined by the atomic numbers of specific atoms: lithium, carbon and fluorine whose numbers are 3, 6 and 9 respectively.

Any particle with a number equal to or greater than 3 will be counted in one channel, equal to or greater than 6 in another and equal to or greater than the 9 in the remaining channel. The detection principle is based upon the fact that all primary particules to be encountered will be completely ionized nuclei having relativistic velocities (greater than 0.9 times the velocity of light).

The ionization chamber employed to detect the particles consists of a cylinder, closed at both ends, with a metallic wire along the axis which is insulated from the rest of the cylinder. The voltage maintained between this wire and the wall of the chamber is such that the wire collects all the electrons produced whenever a charged particle passes through the argon gas.

The total charge reaching the central wire is proportional to the total ionization generated by the particle and hence measures the charge of the particle. Output of the scaler circuits are converted to DC voltages which, in turn, are fed into the 960 cycle oscillator.

4. <u>Micrometeorite Experiment</u>

The experiment is conducted by Herman E. LaGow of NASA. It will detect micrometeorite impacts in the order of 10 micron diameters or larger with a cadmium sulphide evaporated photo conductor. The cell is covered with an optically opaque film. An impact will produce an opening through which sunlight will be admitted to the cell through a diffusion surface of frosted glass.

Admitted sunlight causes a drop in the output resistance of the detector. The telemetering system is designed to report resistance variations between 100,000 and 500 ohms. Orientation of the cells will be provided by data collected from Friedman's aspect indicator.

The micrometeorite experiment originated with the Naval Research Laboratory and the detector was developed by NRL. Three detectors, one temperature sensor and two in-flight calibration resistors of 700 and 20,000 ohms will be utilized. The six outputs will be fed into a sub-carrier oscillator which will phase modulate the tracking transmitter operating on 108 megacycles. The six-channel multiplexer, sub-carrier oscillator and auxiliary equipment were developed by the Army Ballistic Missile Agency.

5. Cosmic Ray Experiment

This experiment is conducted by Dr. James Van Allen of the State University of Iowa, whose detectors carried in the earlier Explorers and the Pioneer space probes measured the Great Radiation Belt in outer space.

The cosmic ray count will be measured by two tubes. One of these, similar to that flown in the Explorer IV satellite, has no special shielding and will be scaled 2048 to 1 to map the radiation belt. The other tube has a lead shield approximately 1 mm thick and will be scaled by 128 to 1 to give the cosmic ray count in the space areas below the belt. The output of both scalers will key a 4-step sub-carrier oscillator with a center frequency of 1300 cps.

6. Exposed Solar Cell Experiment

This experiment is conducted by the Army Ballistic Missile Agency and the Signal Corps' Research and Development Laboratories. An unprotected silicon cell is mounted on the equator of the satellite.

The purpose of the experiment is to determine the performance of an unprotected solar cell in a space environment. When incident light illuminates the cell it develops some 5 volts across a resistor. This voltage is fed into the 960 cps sub-carrier oscillator and the voltage variation, with time, will indicate the effect due to erosion.

7. Temperature Measurements

In previous satellite experiments the temperature data were obtained from indirect measurements. These data are not considered adequate to explain the temperature history of the satellites launched to date.

Several temperatures, in addition to those which are part of the LaGow and Suomi experiments, will be measured in:

a. A very isolated skin area

b. A solar cell cluster

c. In a battery pack

d. One of the Van Allen experiment tubes

These data will be telemetered with the Suomi experiment data.

PARTICIPANTS

Agencies and firms taking part in the experiment are:

BOOSTER SYSTEM -- ABMA, Rocketdyne, Chrysler Corporation, Ford Instrument Company

HIGH SPEED CLUSTER - NASA Jet Propulsion Laboratory operated by the California Institute of Technology

PAYLOAD -

ABMA-Packaging, testing and temperature measurement
NASA-Micrometeorite experiment
STATE UNIVERSITY of IOWA-Radiation experiment
UNIVERSITY OF WISCONSIN-Heat Balance experiment
NAVAL RESEARCH LABORATORY-Lyman-alpha, X-ray experiment
BARTOL RESEARCH FOUNDATION of Franklin Institute, and
RESEARCH INSTITUTE FOR ADVANCED STUDIES of Martin Company
responsible for Heavy Cosmic Ray experiment
ARMY SIGNAL CORPS-Solar Cell, Power Rings
BULOVA WATCH COMPANY-Radio transmitter timer
HOFFMAN ELECTRONICS CORPORATION-Solar cell manufacture

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SATELLITE ELECTRONICS

The electronics systems used in the satellite, launched by the Army Ballistic Missile Agency for the National Aeronautics and Space Administration, were developed by the Agency.

The satellite carries two transmitters. One, operating at 108 megacycles, transmits over a modified loop type antenna. The other, operating at 20 megacycles, transmits over a turnstile type antenna. This radiates circularly polarized waves in the direction of the satellite's axis and linearly polarized waves perpendicular to the axis of the satellite.

All of the scientific experiment measurements except the detection of micrometeorites are fed to the 20 megacycle system.

The primary telemeter system consists of concerters, a multiplexer, four sub-carrier oscillators and a 20 megacycle amplitude modulated transmitter. The converters are designed to convert the pulses received from the heavy cosmic ray counters into step variable DC voltages.

These voltages, the voltages from the Lyman-alpha and X-ray experiments, and battery and solar cell voltages are fed to the time division multiplexer. The output of two scalers in the Van Allen experiment directly modulates a 4-step frequency shift-keyed sub-carrier oscillator (1300 cycles).

The coded output from the Suomi experiment requires the use of two frequency shift keyed sub-carrier oscillators (560 and 730 cycles).

The composite output of the four sub-carrier oscillators are used to amplitude modulate the 20 megacycle transmitter.

The all-transistor transmitter will feed some 600 milliwatts to the antenna at 20 megacycles, and 15 milliwatts at both the 60 and 60mc harmonics. The antenna is made up of four flexible quarter wavelength elements which are unreeled in the plane of the satellite equator from a motor-driven drum located on the satellite's spin axis.

The second telemeter system is used to instrument the micrometeorite experiment and consists of a six channel multiplexer which modulates the 730 cycle voltage controller sub-carrier oscillator. This sub-carrier oscillator is used to phase modulate the 108 megacycle transmitter which feeds 30 milliwatts to the antenna located near the end of the satellite where it was attached to the fourth stage rocket.

The 20 megacycle transmitter and its associated experiments requires some 2.6 watts of continuous power. This is supplied by the Signal Corps designed power system, which utilizes silicon solar energy converters and nickel cadmium batteries.

Solar cells are located in six clusters of 481 cells each so arranged that attitude control for the satellite is not required. They are protected by fused silica glass and the total weight of the power supply including mounting hardware, batteries and other elements is approximately 22.50 pounds.

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MEN BEHIND THE EXPERIMENTS

Following are brief biographies of the principal experimenters and project engineers in the composite radiation satellite experiment:

VEHICLE AND SATELLITE PROJECT ENGINEERS

JOSEPH BOEHM, satellite project engineer for ABMA, has had 20 years experience in rocketry. A mechanical engineering graduate of the Technical University at Dresden, German, he taught five years before joining the von Braun Peenemunde group in 1939. He came to the United States in 1945 as a member of the von Braun team and is chief of the electromechanical engineering branch of ABMA's guidance and control laboratory. He designed the satellites for the early Explorer series.

BILL B. GREEVER, ABMA's Juno II project engineer, is responsible for overall coordination on Juno II projects of the ten laboratories in ABMA's Development Operations Division. A native of Bluefield, W. Va., he received a degree in mechanical engineering from Virginia Polytechnic Institute in 1946. Prior to joining ABMA in 1957, he was an engineer for the Navy's Bureau of Yards and Docks.

EXPERIMENTERS

1. Cosmic Rays

DR. JAMES A. VAN ALLEN - 44, credited with discovery of the radiation belts surrounding the earth. A pioneer in rocket research, directed development of the Aerobee rocket and the "Rockoon" high-altitude rocket balloon experiments. A native of Mt. Pleasant, Iowa, he was graduated from Iowa Weslyan College and earned advanced degrees at the State University of Iowa, where he is now head of the Department of Physics.

GEORGE H. LUDWIG - 31, Dr. Van Allen's graduate student assistant. He was responsible for design and assembly of the space radiation apparatus, and he designed a miniature tape recorder which reported the entire geographical coverage of 500 orbits of Explorer III satellite. The recorder weighed but eight ounces. He is a native of Tiffin, Iowa and was graduated from the State University of Iowa in 1956. He earned his master of science degree there in February.

WILLIAM WHELPLEY - 20, of Cedar Rapids, is a junior honor student and Ludwig's assistant. He constructed electronic nests for the radiation experiment geiger counters.

2. Lyman-alpha X-ray

DR. HERBERT FRIEDMAN - superintendent of the Atmosphere and Astrophysics Division at the Naval Research Laboratory. He was graduated from Brooklyn College in 1936 and received his doctorate from Johns Hopkins University in 1940. He specializes in atmosphere research with rockets, particularly in the field of solar-earth relationships.

DR. TALBOT A. CHUBB - 35, is head of the Upper Air Physics Branch at NRL. He is a native of Pittsburg, Pa., and was graduated in 1944 from Princeton University. He was awarded a doctorate at the University of North Carolina in 1951. Chubb specializes in detection and measurement of ultraviolet radiation.

ROBERT W. KREPLIN - 32, is head of the solar radiation section of the Upper Air Physics Branch at NRL. A native of Cleveland, Ohio, he attended Kansas State College and was graduated from Dartmouth College in 1951. He was awarded a master's degree in 1953 under a teaching fellowship, and currently attends graduate school at the University of Maryland. He specializes in upper atmosphere physics and solar flare studies.

3. Heat Balance

DR. VERNER E. SUOMI - 44, professor of Meteorology at the University of Wisconsin, is a native of Eveleth, Minn.. He attended Winona (Minn.) State Teachers College and received his doctorate from the University of Chicago in 1943.

4. Micrometeorite

HERMAN E. LA GOW - chief of planetary atmospheres programs for NASA, is the space agency's project engineer on this launch. He was employed at NRL until last December and was project leader in Project Vanguard experiments. He was graduated in 1943 from Baylor University and has done graduate work in physics and mathematics at The George Washington University and the University of Maryland.

LUC SECRETAN - a NASA scientist who is La Gow's assistant in the micrometeorite experiment. A native of Switzerland, he was graduated from Swiss Engineering College. He became a U. S. citizen in 1937 and has specialized in satellite environmental instrumentation since 1957 when he joined the Project Vanguard group.

5. Cosmic Rays

DR. GERHART K. GROETZINGER - developed the experiment which is now being carried on by Drs. M. A. Pomerantz and Philip Schwed.

Before his death in March, Dr. Groetzinger attained prominence in the fields of nuclear, cosmic ray and solid state physics. He was associated with several universities and NASA before he joined the Martin Company's REsearch Institute for Advanced Studies (RIAS).

DR. MARTIN A. POMERANTZ - 42, is director-elect of the Bartol Research Foundation. A native of New York City, he studied at Syracuse University, the University of Pennsylvania and Temple University, and he has been engaged in cosmic ray, solid state physics and elementary particle research. He was the first scientist to study heavy nuclei components of cosmic rays by means of an ionization chamber like the one in this payload.

DR. PHILIP SCHWED - 36, of RIAS, was born in Somerville, New Jersey, and received his doctorate from the University of Cincinnati in 1949. Primarily a theoretical physicist working in the solid state and elementary particle fields, he began his association with Dr. Groetzinger when both were employed at NASA's Lewis Research Center in Cleveland.

6. Solar Cells

GEORGE HUNRATH - 49, who designed the electrical system for the giant solar rings that power the new U. S. satellite, has been engaged in the energy conversion field for more than 18 years and holds a number of major patents in the field. He is one of the nation's foremost experts in application of solar batteries to space vehicles. As supervisory general engineer, he guided the development of the solar cell power supplies the U. S. has put into space. Born and educated in New York City, he lives in Shrewsbury, N. J., and has been with the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, since 1941.

ANDREW HERCHAKOWSKI - 37, Army Signal Corps mechanical engineer who designed the huge solar rings that provide all the electrical power for the new U. S. satellite, has been one of the country's pioneers in solar batteries for space. He designed the solar power packages the free world put into space, including an experimental system fired aloft on an Aerobee-hi rocket in 1957, and the solar windows in the Vanguard I satellite launched in 1958. These Vanguard batteries are still providing full power after more than a year in orbit. Herchakowski received his engineering degree from the Catholic University of America, Washington, D. C.

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SATELLITE TRACKING

More than 20 stations around the world have a part in tracking the composite radiation satellite and recording scientific information relayed by the satellite which will be made available to the 66 nationa of IGY.

In addition, hundreds of radio "ham" operators will be able to tune in on at least one of the two main radio bands the satellite is using -- 20 megacycles.

One transmitter operating at 20 megacycles -- powered by solar cells and expected to operate at least a year -- is broadcasting a wavering signal. Recorded and analyzed, this signal provides data on all satellite experiments but the micrometeorite study.

Another transmitter, operating on chemical batteries which should run two months or more, is sending a continuous tracking signal and micrometeorite data on 108 megacycles.

Stations involved in this phase of tracking and data acquisition are NASA minitrack stations at Blossom Point, Md.; San Diego, Calif.; Santiago, Chile; Esselen Park, South Africa and Woomera, Australia, all of which are equipped to receive both 108 and 20 megacycles, and Quito, Ecuador; Lima, Peru and Antafagasta, Chile, which are monitoring the satellite on 108 megacycles. Also, by special arrangement, a Navy installation in Hawaii and the University of Heidelburg, Germany will record 20-megacycle information.

Another experiment is concerned with the paths radio waves take when they bounce off the ionosphere. High-powered receivers at National Bureau of Standards Laboratory, Boulder, Colo., Stanford University, University of Illinois and Penn State University also will monitor the 20-megacycle band to learn more about radio wave propagation.

Initial tracking of the satellite is done by U. S. Army microlock stations. This critical tracking phase of a satellite launching determines the point where the payload is injected into orbit.

Microlock stations measure the position of a vehicle in space by the Doppler effect -- the change in tone of the 108 megacycle tracking signal as the satellite speeds away. In addition, high-powered radars at Cape Canaveral, "watch" the vehicle in the early flight state.

Microlock stations used in this experiment are at Aberdeen Proving Ground, Md., Cape Canaveral, Huntsville, Ala., all operated by ABMA; Cape Hatteras, N. C., Bermuda, Fort Monmouth, N. J. and Van Buren, Maine, all operated by the Army Signal Corps. Measurements received by these stations move by teletype to the ABMA Evaluation Center at Huntsville and into an electronic computer. This gives technicians enough information to be able to predict the satellite's actual orbital path -- intelligence which is then flashed to tracking stations so they know where and when to expect the satellite.

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NOTE TO EDITORS:

October 1 was the first anniversary of the National Aeronautics and Space Administration.

Attached, as background information on NASA's first year, is a brief narrative of the highlights of the endeavors of our first year.

Yrs,
Walter B

Walter T. Bonney, Director
Office of Public Information

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Release No. 59-228
EX. 3-3260
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October 1, 1959

1st Anniversary of NASA

The National Aeronautics and Space Administration is one year old today.

During the first 12 months, the NASA programs included the launch of three probes deep into space and the firing of three satellites into Earth orbits. Each of the instrumented devices has transmitted valuable new information.

Among important developments during the period was organization of Project Mercury, a program of highest priority aimed at firing a manned capsule into an Earth orbit to study human reactions to the space environment. A National Space Vehicle Program was initiated in cooperation with the Department of Defense to provide a family of new rocket engines with higher thrust and reliability, much larger payloads, and greater range than rockets now have. Development contracts were let for five advanced booster systems.

The Space Vehicle Program is being carried on in close cooperation with the Defense Department. To date, every one of the probes and satellites that NASA has launched has been propelled by rockets developed by the military services. In continuing partnership in booster development, it is expected that future rocket systems for which NASA now has responsibility will prove valuable for military space missions.

In aeronautics, NASA has continued a variety of research projects in advanced aircraft and their problems. Chief among these has been a series of preliminary flights with the X-15 research airplane developed in partnership with the Air Force and the Navy. The X-15 will be flown by a pilot to the outer fringes of the Earth's atmosphere at speeds over 4,000 miles an hour.

One of NASA's chief accomplishments in its first year was the progress made toward integrating the civilian-oriented portion of the national space program. Scientific and engineering skills and facilities that had been scattered among several Government agencies and private organizations were drawn together under the aegis of NASA.

Under terms of the National Aeronautics and Space Act of 1958 the President appointed T. Keith Glennan -- president-on-leave of Case Institute of Technology in Cleveland -- Administrator of the agency and Dr. Hugh L. Dryden as Deputy Administrator. Richard E. Horner is Associate Administrator.

The primary purpose of NASA is to develop and manage a national program of aeronautics and space research to acquire and apply knowledge "for the benefit of all mankind."

NASA began operating officially on Wednesday, October 1, 1958. It took over the functions and obligations of the 43-year-old National Advisory Committee for Aeronautics, along with NACA's staff of 7,966 scientists, engineers, technicians, and administrative employes, its Washington, D. C. headquarters and five laboratories and field stations.

On NASA's first day of operation, the President transferred to the agency by Executive Order the following Department of Defense projects:

1) From the Navy, Project Vanguard with 183 scientists and

technologists of the Naval Research Laboratory.

2) From the Air Force and the Advanced Research Projects Agency of the Department of Defense: five space probes, three satellite projects, and several engine research programs, including development of nuclear engines, fluorine engines, and a 1.5 million-pound-thrust, single-chamber rocket engine.

A later Executive Order (December 3, 1958) transferred to NASA from the Army the Jet Propulsion Laboratory (JPL), Los Angeles, California, operated under contract by the California Institute of Technology, with a staff of about 1,500.

On the same date, NASA entered an agreement with the Department of the Army whereby the Army Ballistics Missiles Agency (ABMA) in Huntsville, Alabama, carries out assignments for NASA.

Early in 1959 construction was begun on a new NASA research and development center at Greenbelt, Maryland, near Washington. Authorized by Congress and named for the late Dr. Robert H. Goddard, American rocketry pioneer, the $14 million Goddard Space Flight Center will be ready for occupancy in mid-1960.

* * * * *

NASA Earth satellites that to date have achieved substantial success on their designed missions are:

Vanguard II, meteorological "Cloud Cover Satellite," launched February 17, 1959. The 20.74-pound sphere contained photocells to produce crude images of the Earth's cloud formations. Although the payload developed a wobble that scrambled the transmitter images, its data are now being reduced. Vanguard II proved the feasibility of the weather satellite concept.

Explorer VI, a combination meteorological and scientific satellite, launched August 7, 1959. Sometimes called the "Paddlewheel Satellite", it has four paddle-shaped vanes, studded with solar cells to charge its batteries. The 142-pound sphere is equipped with a photocell to scan the Earth and 14 other experiments. Preliminary examination of data so far transmitted by Explorer VI indicates that the Van Allen Radiation Belt surrounding the Earth consists of many layers instead of the two bands discovered by the simpler instrumentation of earlier satellites and probes. From Explorer VI was transmitted a crude picture of the Earth's surface and cloud cover from a distance of 19,500 miles -- the first photograph taken from such a great distance above the Earth.

Vanguard III, scientific satellite -- last of the Vanguard series launched September 18. The 50-pound payload contained instruments to measure the Earth's magnetic field and X-ray emissions from the Sun.

NASA probes that achieved some degree of success during the past year were:

Pioneer I, first scientific space probe, launched October 11, 1958. Although falling short of its lunar objective, the probe traveled about 70,000 miles before returning to the Earth. Pioneer I scored a number of firsts, including first determination of the radial extent of the Great Radiation Belt; first observation of the oscillations of the Earth's magnetic field and of the interplanetary magnetic field; and first measurements of the density of micrometeorites in space.

Pioneer III, scientific space probe, launched December 6, 1958. This probe, aimed at the Moon, failed its primary objective but traveled 63,580 miles from Earth and discovered that the Van Allen Radiation Belt was comprised of at least two bands.

Pioneer IV, scientific space probe, launched March 3, 1959, achieved an Earth-Moon trajectory. Passing within 37,000 miles of the Moon, the probe went into permanent orbit around the Sun. Pioneer IV, which was tracked some 407,000 miles, provided NASA scientists with an advanced tracking exercise and transmitted excellent radiation data.

On May 28, 1959, an American-born rhesus monkey named Able and a squirrel monkey named Baker were lofted 300 miles into space on a 1500-mile journey in the nose cone of a Jupiter IRBM. Both monkeys were recovered alive although Able died after the journey during an operation to remove an electrode from under her skin. Baker, who is thriving, is being studied by scientists for effects of space flight on primates.

* * * * *

Project Mercury, the nation's manned space flight program, was initiated on October 5, 1958. Project Mercury has two objectives: 1) the study of human capabilities in the space environment; 2) the study of system requirements necessary to sustain the launch, flight, and successful reentry from orbital speeds.

In April, seven Mercury astronauts were selected from among hundreds of military test pilots. The astronauts have been undergoing rigorous training since that time.

NASA's Space Task Group at Langley Research Center directs the project.

On September 9, 1959, a model of the Mercury capsule, mounted on an Atlas missile, was successfully fired from the Atlantic Missile Range. The capsule was recovered in the South Atlantic after surviving reentry temperatures of more than 10,000 degrees Fahrenheit. Although a failure of the Atlas rocket stages to separate caused the capsule to fall short of its programmed flight distance, the resulting steeper reentry angle gave the capsule an even more rigorous heat test than planned. The experiment was termed a success with the fulfillment of its primary research objectives.

Supporting unmanned and manned space missions of the future, NASA's part of the National Space Vehicle Program consists of a series of spaceflight vehicles: Delta, Scout, Vega, Centaur, and Nova. Each is capable of carrying a larger payload and of performing a more complex mission than its predecessors. The program is a studied attempt to get maximum capability with minimum development work. Each vehicle will be used in numerous tests to achieve high reliability and, in most instances, will make use of previously flight-tested engines and vehicles.

NASA personnel on October 1, 1959 totalled 9,347.

NASA's budget for fiscal year 1960 totals $500,575,000, including a 1959 supplemental appropriation of $38.5 million. The current budget includes $335 million for research and development, $91.4 million for salaries and expenses and $73.8 million for construction and equipment. The bulk of the research and equipment money goes directly into private industry and university research contracts.

Plant investment of NASA is estimated at approximately more than $400,000,000. Included are five facilities which pioneered in aeronautical and space research under the National Advisory Committee for Aeronautics:

Ames Research Center, Moffett Field, Calif.
NASA Flight Research Center, Edwards, Calif.
Langley Research Center, Hampton, Virginia
Lewis Research Center, Cleveland, Ohio
Wallops Station, Wallops Island, Virginia

Personnel of a sixth facility, Goddard Space Flight Center, is temporarily housed at various Washington installations while its buildings are under construction at Greenbelt, Md. Jet Propulsion Laboratory, Pasadena, California, operates under contract for NASA.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Release No. 59-232
EX 3-3260
Ext. 7611

FOR RELEASE:
Friday, 1:00 p.m.
October 2, 1959

NUCLEAR ROCKET STUDY PLANNED

The National Aeronautics and Space Administration today announced it will negotiate with Lockheed Aircraft Corp., Georgia Division, on a contract to provide basic engineering data in a continuing feasibility investigation of a nuclear rocket system.

The combined conditions of radiation and extremely low temperatures (around -425 degrees F.) would be encountered in several components of a nuclear rocket using liquid hydrogen as a propellant.

Lockheed was one of seven companies which submitted proposals to NASA. The agency will now negotiate with Lockheed on the basis of its bid for work expected to take more than three years and cost in excess of $1 million.

In this project, the contractor would determine the behavior of possible nuclear rocket materials at very low temperatures while undergoing reactor radiation exposure.

The main part of the study would be run at NASA's Plum Brook Reactor Facility near Sandusky, Ohio. Lockheed proposes to do certain preliminary test work at its Marietta, Ga., plant.

The contractor would be responsible for designing, installing and operating the test at Plum Brook where a 60-megawatt nuclear test reactor has been installed by NASA.

Rocket scientists say the nuclear rocket concept offers promise of powering larger payloads over greater distances than chemical rockets -- both liquid and solid -- now planned.

NASA officials emphasized that the contract under consideration will be a basic research type rather than a developmental contract. "It is simply one step toward trying to find out if a nuclear rocket system is actually feasible. At this point, we just don't know," said one NASA engineer.

- END -

Press Release File

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Release No. 59-235
EX. 3-3260
Ext. 6325

FOR RELEASE:
After Launch
[illegible]

NASA CONDUCTS LITTLE JOE TEST LAUNCH

The National Aeronautics and Space Administration today launched the first in a series of Little Joe boosters in the Project Mercury development program.

Today's firing, held at [illegible] from the Wallops Station launching site, was an operational test of the booster ~~and~~ and destruct launching systems. On top of the Little Joe booster was a boilerplate capsule model with an inert escape rocket system. Neither the capsule nor the escape system was instrumented for this first launch.

In subsequent Little Joe flights, to be held in the fall and winter months, the booster will carry heavily-instrumented test capsules to varying altitudes and ranges. Data from these later flights will provide information on performance of the escape tower, capsule design concepts and operation of recovery parachutes.

The Little Joe propulsion system consists of eight solid-fuel motors. There are four larger motors, called Pollux, and four Recruits. The clustered rocket package provides a takeoff thrust of about a quarter of a million pounds. Takeoff weight of the 55-foot fin-stabilized booster is about 20 tons.

As part of the developmental test, the vehicle was intentionally destroyed about 2½ minutes after launch at an altitude of about 40 miles over the Atlantic Ocean.

~~Flight trajectory in today's test was an altitude of ________ miles and a range of ________ miles. No attempt was made to recover the boilerplate apparatus.~~

The Wallops Station firing team was headed by John C. Palmer, chief of the Flight Test Division. The booster was assembled on-site by engineers of NASA's Langley Research Center, which is conducting the Little Joe program for the Space Task Group as part of its support for the Mercury project. Carl A. Sandahl is technical coordinator for Langley support activities in Project Mercury, and Roland D. English is Little Joe project engineer.

NASA's Space Task Group has overall responsibility for Project Mercury and is headquartered at the Langley Research Center. Representing the group as senior test engineer in Little Joe operations is William D. Bland.

INDUSTRIAL PARTICIPATION

Both Pollux and Recruit rockets are products of the Thiokol Chemical Corporation, and were supplied by NASA by the Army Rocket and Guided Missile Agency, Huntsville, Alabama.

The aluminum alloy airframe was built by North American Aviation Missile Division, Downey, California. This firm also is contractor for the launcher and for some ground handling equipment.

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Release No. 59-234
EX. 3-3260
Ext. 6325

FOR RELEASE:
Thursday, AM's
October 8, 1959

PIONEER IV REACHES FIRST APHELION

The United States space probe, Pioneer IV, launched from the Atlantic Missile Range at 12:10:56 a.m. EST last March 3, today reaches its farthest point from the sun in its ceaseless swing around that body in the solar system.

Scientists at the California Institute of Technology Jet Propulsion Laboratory, a research facility of the National Aeronautics and Space Administration, said Pioneer IV's aphelion, farthest point from the sun occurs at 8 p.m. EST October 8.

They estimated the distance from the sun at aphelion at 107,951,000 miles.

JPL joined with the Army Ballistic Missile Agency last March to fire Pioneer IV, the first successful U. S. space probe, for NASA.

The chemical batteries which powered the transmitters in the 13.4-pound gold plated cone shaped payload went dead 82 hours and four minutes after launch, at which time the transmitters ceased operating.

At that time, JPL's Goldstone tracking station -- an 85-foot diameter antenna in the California desert -- lost the signal when Pioneer IV was 407,000 miles from the earth and well beyond the moon. The distance represents a new tracking record.

Although signals from Pioneer IV ceased at that time, scientists at JPL pointed out that its speed -- in excess of earth escape velocity -- and trajectory meant that it had to act in accordance with immutable laws of physics and enter a precise path around the sun.

Here are the figures, refined over earlier estimates, on the Pioneer IV orbit:

Perihelion (closest point to the sun), March 18, 1959, at 9 a.m. EST, 91,720,000 miles.

Speed at Perihelion -- 70,440 miles per hour (with respect to the sun).

Aphelion (farthest point from the sun) -- October 8, 1959, at 8 p.m. EST, 107,951,000 miles.

Speed at aphelion -- 59,848 miles per hour (with respect to the sun).

Period of orbit around the Sun -- 406.95 days.

Average speed in sun orbit -- 65,144 miles per hour (with respect to the sun).

Distance inside the average earth orbit at perihelion -- 1,236,000 miles.

Distance outside the average earth orbit at aphelion -- 14,995,000 miles.

For comparative purposes, here is the heliocentric orbit of the Russian Mechta, launched into heliocentric orbit January 2, 1959:

Perihelion -- January 14, 1959, 91,100,000 miles.

Aphelion -- August 21, 1959, 120,000,000 miles.

Period of orbit -- 443 days.

Average speed of Mechta in sun orbit -- 63,100 miles per hour (with respect to sun).

- END -

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D. C.

BACKGROUND INFORMATION
1.5-MILLION-POUND SINGLE CHAMBER ENGINE

Langley Research Center, Va., October 12-- Shortly after NASA began operations, its propulsion scientists initiated a long lead-time program to develop the largest booster in the National Space Vehicle Program. Like smaller boosters, it is in keeping with the principle of multiple use of other rocket engines for its upper stages, but one new engine is required.

On October 12, 1958, less than two weeks after it became operational, NASA invited bids from major aircraft contractors for a one- to one-and-a-half million pound thrust single chamber engine. A contract was awarded Rocketdyne Division of North American Aviation on January 9, 1959, for a $102 million four- to six-year development program.

Although another space vehicle under development is designed to achieve 1.5 million pounds thrust by clustering existing ICBM and IRBM boosters, this engine would produce a thrust far greater than any other single chamber engine in the national booster program. And several of the single chamber engines can be clustered to provide a vehicle of at least 6 million pounds thrust to accomplish advanced space missions where payloads of several tons are required.

The big single chamber engine under development is the conventional chemical type using kerosene and liquid oxygen which are pumped into the combustion chamber at almost three tons per second. Combustion will generate temperatures of more than 5500° F.

The 1.5 million pound thrust single chamber engine still is in early stages of development but the fuel injector has been tested in excess of one million pounds thrust.

In cooperation with the Air Force, test facilities will be used at Edwards Air Force Base in the Mojave Desert, California. One test stand will be in use early next year on this project and construction on another stand will begin soon.

NASA propulsion scientists envision using a space vehicle powered by a cluster of these powerful engines as a heavy duty truck in space. Its tremendous thrust would enable it to put into orbit a 150,000 pound space laboratory-- about the size of a small house-- for detailed experiments in a space environment. And with this vehicle a manned lunar landing and return first will become possible.

This vehicle, sometimes called NOVA, would have to be erected on its launching pad. Its number of stages, built on top of a first stage made up of six 1.5 million pound thrust engines, would depend on its specific mission. It would stand about as tall as a twenty story building and weigh more than six million pounds at take-off.

For a manned lunar expedition and return, a five- or six-stage vehicle would be used. The trip, lasting about two-and-a-half days, would put two men on the surface of the moon in a three-ton space capsule containing their life support system. The capsule would be directed to a selected landing spot on the moon by a beacon rocket landed earlier in the area.

Scientists believe it would take the first three stages of the vehicle to provide sufficient velocity for the lunar trip-- the first two using the 1.5 million pound thrust engine in cluster. The third stage would be fueled by high-energy propellants as would the fourth which would provide retro thrust for a soft landing on the lunar surface.

On the moon, the two men would have about 12 days in which to carry out scientific experiments until astronomical conditions are right for their return trip. To return, they would fire the fifth stage rocket using the burned out fourth stage as a launching platform.

The firing would boost their capsule out of the gravitational pull of the moon and on its way back to earth. A sixth stage possibly would be used to slow lown the rocket on its approach to earth before huge parachutes were deployed for a landing.

NASA scientists believe it will take four or five years to complete development of the 1.5 million pound thrust single chamber engine. The construction of a vehicle employing these engines in cluster is expected to take another two or three years.

October 12, 1959

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D. C.

BACKGROUND INFORMATION
X-15 RESEARCH AIRPLANE

Langley Research Center, Va., October 12-- The X-15 is the most advanced research airplane in the history of aeronautics. Sometime within the next two years it will carry its pilot out beyond the earth's effective atmosphere at speeds never before approached by a piloted aircraft.

Sponsored jointly by the U.S. Air Force, the National Aeronautics and Space Administration, and the U.S. Navy, the X-15 project has drawn upon the know-how of scientists and engineers in both Government and industry.

In 1952, foreseeing the necessity of space flight research, the National Advisory Committee for Aeronautics (the predecessor of the NASA) inaugurated in-house studies of the problems which would have to be solved before manned space flight could be feasible. Two years later, NACA had pin-pointed these problem areas through aerodynamic studies including wind tunnel tests, and had established preliminary specifications for an airplane best suited as a research vehicle for studies of aerodynamic heating, stability and control, and pilot reaction at hypersonic speeds and at altitudes up to 100 miles.

The result is the X-15, built by North American Aviation, Inc., and powered by the XLR-99, this nation's most advanced airplane rocket engine, manufactured by Reaction Motors Division of Thiokol Chemical Corp.

Of the three planes to be built, two have already been delivered to Edwards Air Force Base, California, adjacent to NASA's Flight Research Center, where contractor demonstration flights are now underway. Pending delivery of the XLR-99 engines this fall, the early powered flights of the X-15 make use of a combination of two RMD XLR-11 rocket motors (the same used in the X-1 research plane) totaling 16,000 pounds of thrust. The XLR-99 will be capable of producing more than 50,000 pounds of thrust, and speeds over 3,600 miles per hour.

After the contractor demonstration flights, the X-15 will be turned over to the Government for an NASA-conducted research flight test program. This phase of the program is also a cooperative effort. The X-15 test pilot pool will consist of specially trained NASA, Air Force, and Naval aviators. The Air Force will assist in funding the research flight program.

Following a carefully pre-arranged flight plan, the plane's performance will be gradually increased until it reaches maximum capability. Tracking and telemetry recording equipment has been installed under the supervision of the NASA from Wendover Air Force Base, Utah, to Edwards, along the 485-mile route over which the X-15 will fly. The plane will be heavily instrumented so that engineers and technicians on the ground will be able to monitor the effects of high altitudes and speeds on the aircraft's structure and performance. In addition, special instrumentation will record the pilot's physiological reactions.

The X-15 is not equipped with conventional takeoff and landing gear. It is carried to 38,000 feet by a modified B-52, dropped, and then it continues in flight under its own rocket power. The plane lands on skids.

The rocket power plant, fueled with liquid oxygen and liquid ammonia, has a maximum burning time a little under four minutes. In a flight to the edge of space and back, which will take less than 30 minutes, the major portion will be unpowered or gliding flight, similar to a ballistic trajectory.

The pilot will fly a programmed flight path. Angle and rate of climb during powered flight will determine the trajectory. After engine burnout, the plane is committed to its course. Above an altitude of about 30 miles the X-15's control surfaces will no longer be effective. However, the pilot can maintain proper ballistic attitude by activating small control rockets in the nose and wings. Aircraft attitude is extremely important during the flight, especially while the plane is re-entering the atmosphere and aerodynamic heating can become critical. Once in the atmosphere, the pilot will land the plane using conventional controls.

Each flight of the X-15 during the research program will provide scientific information applicable both to aerodynamics and space flight. Speed and altitude records presumably will be broken, but only after a gradual build-up program and only as a corollary to scientific research.

What are some of the areas for which the X-15 will provide research information?

---Aerodynamic heating. It is anticipated that the aircraft will encounter temperatures up to 1,200 degrees F. How will this effect the Inconel X airframe; how much and at what rate will heat transfer from one section of the plane to another?

---Aircraft control and stability. How will an aircraft perform and how will it handle under accelerations and decelerations up to the order of 7 G's?

---Exit and re-entry data. This research information will figure importantly in all future manned space vehicles which must guarantee safe passage both in and out of the earth's heavy blanket of atmosphere.

---Physiological and psychological human reaction. The X-15 pilot will be subjected to the longest period of weightlessness yet encountered, something on the order of five minutes. The force on his body during the re-entry maneuver will be about seven times his own weight. At hypersonic speeds and at extremely high altitudes, pilot reaction must be swift and sure.

Research information resulting from the X-15 program will be made available to industry and to the military services both in a series of major conferences and by means of technical reports.

The X-15 is the latest in a series of research airplanes, developed through the resources of Government and industry. These planes which have pushed back the frontiers of flight include the X-1 series, the D-558, X-4, X-5, X-3, and X-2.

October 12, 1959

IMMEDIATE RELEASE October 21, 1959

James C. Hagerty, Press Secretary to the President

THE WHITE HOUSE
(Augusta, Georgia)

STATEMENT BY THE PRESIDENT

To strengthen the national space effort and provide for America's changing requirements in this field, I have concluded that the Army Ballistic Missiles Agency can best serve the national interest as an integral part of the National Aeronautics and Space Administration. The Army Ballistic Missiles Agency team has demonstrated its intense dedication in this field and has shown its high technical proficiency through splendid accomplishments under Army aegis.

The contemplated transfer provides new opportunity for them to contribute their special capabilities directly to the expanding civilian space program.

As part of this action, the development of "super-booster" space vehicles will be consolidated in the National Aeronautics and Space Administration, under the immediate direction of this team. I have directed that this program be vigorously pressed forward.

The specific plan and details involved in this transfer, including provision for continuation of military missile programs now assigned to the Army Ballistic Missiles Agency, will be ready to lay before the Congress when it reconvenes.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

Release No. 59-242

For Immediate Release
October 21, 1959

Statement for the Press by

Dr. T. Keith Glennan, Administrator

"I believe the President's action today announcing his intention to transfer the Development Operations Division of the Army Ballistic Missile Agency to NASA is in the best interest of the nation. It will contribute to the strengthening of the national space program. The President's action further clarifies the management organization of the nation's space program, with NASA now assuming responsibility for the development of space booster vehicle systems of high thrust -- the field of dominant interest to the personnel of the Development Operations Division of ABMA.

"We at NASA feel it most fortunate that this Division will become an integral part of our organization. The scientists and engineers of ABMA have earned a worldwide reputation for excellence in their field and have become a national asset.

"During the past year, ABMA contributions to NASA space programs have been characterized by dedicated teamwork and cordial relationships. I look forward to this new relationship with real enthusiasm.

"Within a few days a team of specialists will begin working with their counterparts in the Army and other Federal agencies to work out the details of the transfer."

- END -

October 21, 1959

Statement by Dr. Wernher von Braun, ABMA

"At the moment I haveno official information concerning the transfer of the Development Operations Division of the ABMA to NASA to supplement the press bulletins I have seen. Consequently I am not in a position to make a detailed comment.

"Our association with the U. S. Army has been a most satisfactory and fruitful one. As an Army-civilian team, we have had the emmintently gratifying experience of launching the free world's first space satellite and many of its successors,including the most recent one launched on October 13, 1959.

"The major concern of my colleagues and myself is that we be permitted to continue to devote ourselves to this country's space efforts. The President has decided that it is in the best interest of the country that our work be done within the framework of NASA. Since NASA's establishment a year ago, we have worked closely and harmoniously with that fine organization. We look forward to a continuation of our efforts with NASA in a progressive space program which will make this nation second to none"

END

Dictated by Lt.Col.Vernon Pizer, ABMA, 6 p.m. 10/21/59

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

RELEASE NO. 59-237
EX 3-3260
Ext. 6325

FOR RELEASE
AFTER LAUNCH
OCT 28 1959

NASA 100-FOOT SPHERE TEST LAUNCH

The National Aeronautics and Space Administration today launched a test vehicle carrying a 100-foot diameter inflatable sphere on a sub-orbital flight over the Atlantic Ocean.

Today's firing, held at 5:40 p.m. EDT from the Wallops Station, Va., launch site, was designed to test:

- Ejection and inflation processes of the 100-foot sphere in the space environment. The size of the sphere makes it impossible to test it in a ground facility.
- Operation of the solid propellant third stage of the Delta vehicle under development in NASA's space vehicle program.

The vehicle boosted the sphere to an altitude of about 250 miles. It traveled 500 miles east across the Atlantic.

Today's launch was by a two-stage vehicle which stood 32½ feet high and weighed five and one-half tons at take-off. It produced an initial thrust of 130,000 pounds.

The first stage was one Sergeant solid rocket with two

Recruit assist rockets to increase initial thrust. The second stage, originally developed for Vanguard, was an Allegany Ballistics Laboratory X-248 solid rocket which will be the third stage for the Delta vehicle.

The Delta will use a Thor IRBM first stage and an Aerojet-General liquid propellant second stage which has been used in the Vanguard and Thor-Able vehicles. Under development by contract to Douglas Aircraft Company, the Delta is scheduled to begin a variety of satellite and space probe missions for NASA next year. Among its missions will be injection into orbit of a 100-foot inflatable sphere as a passive communications satellite.

The sphere was made of mylar plastic coated with aluminum half a mil thick (half of one thousandth of an inch). It weighed about 130 pounds. The aluminum provided a high degree of reflectivity of light and radio signals.

At launch the sphere was folded into a round magnesium container 26½ inches in diameter. The complete payload package weighed 190 pounds.

After ejection from the container, inflation of the sphere was begun by residual air inside it. Inflation was completed when four pounds of water, released from two plastic bags, vaporized and fully inflated the 523,598 cubic foot sphere.

The payload did not carry a beacon transmitter for tracking but a telemetry transmitter reported vehicle performance to ground stations at Wallops.

The 100-foot sphere was conceived by Langley's Space Vehicle Group headed by William J. O'Sullivan Jr. The vehicle was developed by Langley's Pilotless Aircraft Research Division. Project engineer was Norman L. Crabill of PARD. Leonard Jaffe of NASA Headquarters is chief of communications satellite programs.

-END-

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

FOR RELEASE P.M's
Wed., Oct. 28, 1959

Address by T. Keith Glennan

Administrator

National Aeronautics and Space Administration

before

The American Bankers Association

Miami Beach, Florida, October 28, 1959

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It isn't an everyday occurrence for me to have the leaders of the American banking profession as interested listeners. For half an hour or so, I intend to take full advantage of the opportunity.

I know that this audience is composed of men and women who are realists. At the same time, you must be dreamers -- practical dreamers -- that is to say, people who by insight and training are able to assess both the facts and the implications of current situations. Your assessments lead you to supply or withhold the important financial resources that are required to develop the promises described by the few in a dynamic, living actuality for the many. To the vision, wisdom, and faith of the banking community, the United States owes, in no small measure, the force and greatness of its culture and power.

You want facts, and I want to give you the facts, as I know them, about the National Space Program. When I have finished, I hope you will have a better picture than you thus far have had of our nation's space activities and of our planning for the future.

When I have finished, I hope you will have concluded that ours is an imaginative, hard-hitting program being planned and prosecuted in the best interests of present and future generations of our people -- and, indeed, of all mankind.

In order to concentrate our attention on the National Space Program, I must first clarify the relationship between accomplishments of the Soviet Union in the space field and the capability of the United States Intermediate Range Ballistic Missile (IRBM) and Intercontinental Ballistic Missile (ICBM) military weapons systems. The Soviet space achievements can be credited largely to their use of rocket-propulsion devices having substantially higher thrust than ours. This higher thrust capability enables them to carry heavy scientific payloads -- sensors, instrumentation, and communications equipment -- and well-developed guidance equipment necessary to accomplish difficult space missions. Our space vehicle systems are based on rocket boosters of substantially lower thrust than theirs, and we simply cannot carry both heavy payloads and highly reliable and precise guidance systems on our space missions.

You may well ask: How did this come about? Does it mean that our ballistic missiles -- the same ones which serve as the basic boosters for our space vehicle systems -- are unable to carry nuclear warheads of the required destructive capability to their assigned targets with the required accuracy? Is the American public being deceived in this matter?

As a basic premise, of course, ballistic missile rockets must be large enough and powerful enough to deliver the warhead on the selected target. But there is no particular virtue in having one twice as powerful as necessary to carry the largest, heaviest, and most destructive warhead you are prepared to employ. Indeed, the smaller they can be made, the less costly and more reliable they are apt to be. Thus more of them can be had for a given sum of money.

The Russians started intensive development of their large rockets shortly after World War II. It appears that, with their customary singleness of purpose, they made an early decision to concentrate on rocket-propelled ICBMs as the delivery system for the nuclear weapons they were developing. At that time, our reliance for delivery of nuclear weapons was placed almost wholly on the big bombers of our Strategic Air Command.

Now it is necessary to realize that the nuclear weapons of the late 'forties and very early 'fifties were very much heavier, more bulky, and much less efficient in their use of nuclear materials than those developed in the early mid-'fifties -- say in the 1952-'54 period. Thus the early Soviet decision to center their delivery systems development efforts on the ballistic missile required that they develop a large rocket with very high thrust to carry the heavy weapons then available. On the other hand, by 1953 our AEC laboratories had been so successful in their efforts to improve the efficiency of our atomic and hydrogen weapons that our delayed start -- in that year -- on a crash ballistic missile program made it possible for us to design our rockets for the lower thrusts required to carry these more efficient and much lighter weapons. Here is the result, stated bluntly: Our Thor, Jupiter, and Atlas missiles, all of which are operational, have the necessary [illegible] and [illegible] to [illegible] nuclear weapons [illegible] destruction [illegible] military targets [illegible] Thor and Jupiter [illegible] have

already been deployed in quantity. The Titan ICBM, now in the test stage, should be equally satisfactory for its military mission. This, gentlemen, is an accomplishment of which we can be proud.

Turning now to space exploration, it becomes clear that our lack of need for very high thrust ballistic missiles to carry our nuclear warheads has played a strong hand against us in what has been termed the competition for space with the Soviet Union. Actually, our largest available rocket booster, the Atlas, is designed to provide approximately half the estimated thrust of the Soviet first-stage rocket booster. To compound our problem, we can only now begin to use the Atlas as our basic booster rocket -- some two years after the Russians launched Sputnik I. Thus we are two years late already, and we must for a long time to come -- perhaps for as long as three or four years -- continue to use the Atlas or its counterpart, the Titan, as the basic booster for our space vehicle systems.

However, there is one really bright spot in the picture. It is possible to develop suitably proportioned upper stages to ride on the Atlas -- as a first-stage booster -- and thus very greatly increase the load-carrying capacity of the total vehicle system. This we are doing with urgency. I will say more about this program later.

No useful purpose would be served by making excuses for this situation. But it is vital that our people understand the facts that confront us. Speeches and newspaper articles are not going to provide the greater thrust needed for accurate propulsion of heavy payloads into satellite orbits or on deep space trajectories. I suspect, however, that if we were able to contain and use as a propellant all the hot air that has been expended on this subject lately, we could have at least one vehicle of really high thrust.

What we need, and what I believe we now have, is a program of rocket booster development which will permit us to overcome these handicaps in the reasonably near future so that we can undertake the sort of experiments and adventures in space that will satisfy our curiosity about the unknown. Our ultimate goal is to explore with both unmanned and manned vehicles the planets and the space that separates us from them. While I have already taken a good bit of your time discussing rocket boosters, I am going to take even more later on. I am not doing this because I an enamoured of rockets as such. They are merely the devices that we must use if we are to carry out our experimentation and exploration in the space environment. They are exceedingly costly, temperamental, but necessary common carriers to outer space.

Now, let me give you a picture of the organization we have put together to carry out the National Space Program.

Just thirteen months ago, the National Aeronautics and Space Administration was declared to be in business. Let me hasten to emphasize that we are not "just another alphabetical Government agency" new-born to add confusion to the Washington scene. At the outset, NASA absorbed the National Advisory Committee for Aeronautics, a highly respected, 43-year-old aeronautical research and development organization with rich resources in terms of men, experience, and equipment. With this nucleus of nearly 8,000 scientists, engineers, and administrative personnel, and laboratories such as Langley in Virginia, Lewis in Ohio, and Ames in California, NASA was off to a flying start that would not have been possible otherwise.

NASA is new in the sense that its mission is vastly broader than that of NACA, which was essentially a research organization. NASA has been commissioned by the President and Congress to direct <u>all</u> non-military aeronautical and space research and development. In addition, we are instructed in our law to work closely with the military and do, in fact, make a sizable research contribution to the military aircraft and missile programs. NASA scientists and engineers are hard at work on problems connected with a variety of military and civilian aircraft and with about every missile in our arsenal, a fact which is not generally appreciated. May I add, parenthetically, for those who are particularly interested in aeronautics, that we will continue to devote a substantial fraction of our in-house research capability to solving the problems of atmospheric flight and investigating the feasibility of supersonic transports for the long-range future.

As you may recall, numerous projects have been transferred to us from the military during the past months. Initially, we acquired the Vanguard team of highly competent scientists from the Naval Research Laboratory, later the services of the Jet Propulsion Laboratory of California Institute of Technology, and, just the other day, a substantial fraction of the Army's Ballistics Missiles Agency of Huntsville, Alabama -- principally its Development Operations Division headed by Dr. Wernher von Braun.

With this transfer becoming effective in the early days of the next session of Congress, our total governmental staff in this field will number, as of June 30, 1960, more than 14,000 persons.

The President's decision to transfer the Huntsville group to NASA -- subject to Congressional approval -- seems to me a logical one. It will put under one management the great majority of the government's scientists and engineers who are interested and active in understanding and using the space environment for peaceful purposes. As the President stated, "The contemplated transfer provides new opportunity for them to contribute their special capabilities directly to the expanding civilian space program."

The Huntsville group will now have the advantage of working more closely with our other laboratories in the same field, rather than operating as a more or less isolated group. Its responsibilities will not be curtailed or diminished -- in fact, quite the contrary. We have enjoyed harmonious relationships as separate entities; we intend to make full use of their proven capabilities when they become part of the NASA team.

Let me turn now to the program we have laid out for the short and long-term future as we now see it. I emphasize the word <u>now</u> for this is the most fluid of businesses, subject to constant and continuing review and evaluation in light of fast-breaking developments.

The major components of our National Space Program are as follows:

First: Manned flight in space, of which Project Mercury is the first step. About 15 percent of our effort, measured in 1960 budget dollars is being expended on this project.

Second: Scientific exploration of the upper atmosphere and outer space represents about 15 percent of our 1960 budget dollars. Our search for new knowledge will involve us in many satellite and deep space missions. For the present and immediate future these will be carried out with the space systems of relatively small capacity now available to us. As new vehicle developments come into use -- and I will describe the space vehicle development program later in this paper -- we will undertake an extended series of lunar missions and interplanetary and planetary experiments. These missions will lead ultimately to manned exploration of outer space, the Moon, and, hopefully, of the planets -- although these latter exploits are a long way off, as I see it.

Some of these basic experiments will be made in areas of scientific interest that should result, ultimately, in useful operating systems for civilian applications and, in some cases, for military use as well. Most often mentioned in this category are the meteorological and communications fields; we have active programs in both.

Third: The National Space Vehicle Program. Recognizing early in our existence that propulsion was to prove a real limiting factor in our ability to get ahead with our task, we established a space vehicle program with the following guiding principles:

a) The space program requires the development of a limited series of new space flight vehicles having increased payload capabilities for successive periods of use.

b) These new vehicle types, when fitted with the payload and guidance appropriate to a mission, must serve for most of the space missions planned for the future.

c) Reliability must be increased through the continuing use of a given space vehicle design for a maximum variety of payloads and missions.

As an all-purpose, relatively inexpensive space vehicle system, we have developed with very substantial assistance from industry, a solid-propellant, four-stage vehicle known as the Scout. It should be capable of placing a payload of 200 to 250 pounds into a 300-mile orbit (a convenient orbital height to use in comparing propulsion systems) with a limited precision and at a launch cost of $500,000 to $600,000. In various configurations, the Scout will be used as a vertical sounding rocket or as a satellite launching vehicle. Military interest in this vehicle for research purposes is quite high.

In the next larger category, we have a number of vehicle systems being used or planned for use in the immediate future as we move toward a single IRBM-based vehicle. These vehicle systems now carry from 75 to 300 pounds. By the early fall of 1960, there should be available the preferred vehicle system in this class. It should be able to place 1,200 pounds in a 300-mile orbit.

Then, in the Atlas-based systems, NASA is developing two vehicles: the Vega and the Centaur. The first is an optimized use of the Atlas with the upper stages burning conventional liquid propellants -- kerosene as the fuel with liquid oxygen as the oxidant. In its three-stage version, which should be ready for initial flights early in 1961, Vega will place 4,800 pounds in a 300-mile orbit and 1000 pounds into a deep space trajectory; that is, a shot intended to propel the payload to the Moon and beyond. This program, unfortunately, is now being set back by the shortages resulting from the steel strike.

The Centaur will be the first system to include upper stages using liquid hydrogen as a high energy fuel. It will employ an Atlas as a first-stage booster and will be capable of launching 8,000 pounds into a 300-mile orbit or 2,300 pounds into a deep space trajectory. Much remains to be known about the behavior and storage of liquid hydrogen in a weightless condition in a hard vacuum. But we have high hopes for this system and might well use it as a replacement for the Vega vehicle if it proves satisfactory.

As the situation stands now, it is reasonably certain that in early 1961 the Vega will be the first of our space-vehicle systems capable of matching the performance demonstrated by the Russians more than a year ago. And I have no doubt that the Russians will be improving their systems during this same period.

Finally, we come to the Saturn and its derivatives, which will be able to loft 30,000 pounds to the 300-mile orbit initially, and more than 200,000 pounds in the later versions. These will not be available for use until the 1964-65 period unless we have much better luck than we have any right to expect.

While all this effort -- representing about 25 percent of our budget dollars in Fiscal Year 1960 -- is going forward, we will be carrying out many experiments using the less efficient vehicles assembled from existing rocket units, mostly those based on the Thor IRBM as a first stage.

The fourth major segment of our program is that of supporting research and advanced technological development and the management of our research and development activities, both in-house and under contract. While much of this work is carried out in our own research centers, we do support advanced component development through contracts with industry. A little more than 25 percent of our budget dollars are used in this category.

Finally, 18 to 20 percent of our budget provides for our research facilities and a world-wide tracking and data-acquisition network.

Operating in Fiscal Year 1960 at a budgetary level of $501 million, we will spend about 70 percent of those dollars with industry or with other contractors.

I have taken your time to give this condensed picture of the important segments of our national space program because I believe it to be soundly conceived, well-planned and designed to bring us useful results. It is not a half-hearted approach to this exciting new field. It is our own program -- not a reaction to the Russian program or an attempt to outguess it. It represents our best efforts to make the most out of the capabilities we now possess while we drive ahead to increase our propulsive thrust at the earliest possible time.

Many critics seem determined to cast the U.S. space program solely in a competitive relationship with that of the Soviet Union. To an extent, this rivalry is important and significant. As I have said before, we cannot be a leader in a race if we continue to run second.

But it is my belief that man would now be engaging in the approaches to space exploration even if there were no technological rivalry between the Communists and the Free World -- although the effort certainly would not be as great nor the pace as pressing. Science and technology have reached the stage where the next logical step is outward. As Mark Twain quoted an old Mississippi River pilot on a great technical advance of another day: "When it's steamboat time, you steamboat."

Now it is "space time."

I am convinced that space exploration will return to the economy many dividends which at this stage we can envision only dimly. I have mentioned the meteorological and communications systems which many of us believe will return very real economic benefits to the economy in the foreseeable future. Others that can logically be expected include: application of space-vehicle inertial guidance to aircraft; adaptation of data-processing systems used in space experiments to commercial and industrial ends;

utilization of high-temperature, high-strength alloys for industrial products; and, of course, adaptation of the super-miniaturization techniques -- necessary to make space payloads compact -- to provide much smaller, lighter, and more efficient office, plant, and home appliances of many kinds.

This "feed-back" into the economy may eventually be worth many times over all the funds we spend on space. It is from this standpoint, as well as for considerations of national defense and prestige, that we should measure the value of space research and development.

In closing, may I repeat that the National Space Program is making good, sound progress. It will continue to progress at an accelerating pace. We do not intend to whine or grow hysterical every time the Russians score. We do not intend to rush pell-mell into makeshift space "spectaculars" in hopes of topping each Soviet space success. But I can assure you that we do not intend for long to run second in any phase of space exploration.

Time is the key element, and in time the United States will prevail over the present challenge in space as it has over other equally harsh challenges in the past.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D. C.

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FOR RELEASE P.M.'s
Wed., Oct. 28, 1959

SPECIAL MEMO TO EDITORS

Our typists have committed an error in Release Number 59-243, the statement Dr. T. Keith Glennan is making before the American Bankers Association, Miami Beach, Florida, October 28, 1959. The correction starts on the bottom of page three, the last two lines, and continues onto page four. Here is how this part of the statement should read:

"...lighter weapons. Here is the result, stated bluntly: Our Thor, Jupiter and Atlas missiles, all of which are operational, have the necessary guidance and thrust to deliver nuclear weapons with the desired destructive force on military targets wherever they may be. The Thor and Jupiter, incidentally, have already been deployed in quantity. The Titan ICBM..."

I hope that we have gotten this correction to you in time to meet your deadlines.

Herb Rosen
Deputy Director, Office of
Public Information